

SPECIFICATION  
NO. TF-1  
6 October 1966

PRELIM.

CONSTRUCTION SPECIFICATION

FOR

TRANSMITTER FACILITIES

25X1A

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ROOF COATING

ELECT. WORK; EXTERIOR

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**PURCHASE SPECIFICATIONS FOR GOVERNMENT**

25X1A

**PROCURED ITEMS FOR [REDACTED] TRANSMITTER****POWER PLANT**

25X1A



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**1.0 Scope:** The work includes the purchase of diesel electric generators, switchboard, and associated equipment, complete, in strict accordance with this specification and subject to the terms and conditions of the Contract.

**2.0 Diesel-Electric Generator:** The generator unit shall consist of a diesel engine, radiator cooled, direct connected to a single bearing, forged flanged shaft, coupled type generator with static exciter, all mounted on a structural steel common subbase. Unit shall be suitable for continuous operation at the rating and condition indicated. The diesel engine shall meet the requirements of the latest Edition of "Standard Practices" of the Diesel Engine Manufacturers' Association. The generator shall conform to IEEE and NEMA Standards.

**2.1 Diesel Engine:** shall be four cycle, either vertical or V-type, multi-cylinder, with individual mechanical injection pump and individual injection nozzles located at each cylinder of the engine. Engine shall have trunk-type pistons and removable cylinder liners.

The limiting specifications of the engines shall be:

Number of cylinders	Not less than 6
Rated rpm.	Not to exceed 1,200
Rated Piston Speed	Not to exceed 1,350 fpm.
Rated BMEP	Not to exceed 120 psi
Elevation	0 - 1,500 feet
Ambient Temperature	40°C

Fuel consumption based on fuel having a high heat value of 19,350 Btu.  
per pound shall not exceed the following:

- 0.360 lbs. per BHP hr. @ full load
- 0.560 lbs. per BHP hr. @ 3/4 load
- 0.630 lbs. per BHP hr. @ 1/2 load

The engine shall be capable of operating at light loads (3-10% of rated load) for extended periods of time and shall provide for precombustion of the fuel or a similar means for the prevention of carbonization.

*See 213  
233V refpt*

**2.2 Governing System** The speed governing system shall conform to the AIEE Specification No. 606, Section II, III or IV. The governor shall be isochronous, hydraulic type, motor actuated mechanism for remote control adjustment, adjustable droop, suitable for parallel operation. Governor motor shall be suitable for 220V a-c, internally connected to generator. An overspeed device entirely independent of the engine governing system shall be supplied. A governor motor control switch shall be provided for remote mounting.

**2.3 Engine Fuel System** The fuel system shall include engine-driven fuel supply pump, engine-mounted duplex strainers, duplex filters and appurtenances, complete with pipe, fittings and valves. Fuel lines shall be plugged or capped ready for field connections. Flexible pipe connections shall be supplied for fuel lines to be installed in the field. A motor-driven diesel fuel transfer pump shall be provided to transfer fuel from a fuel storage tank to a fuel day tank. The pump shall be a positive displacement type or rotary type, 20 gpm. capacity, 30 feet total dynamic head directly driven by a 3-phase, 200-volt, 60-cycle 1750-rpm electric motor. Pump and motor shall be mounted on a common steel base for concrete floor mounting. A 10 gal. @ 100 revolutions and 50 feet head, wall-mounted rotary-type hand pump shall also be provided.

**2.4 Engine Lubricating Oil System** The engine shall be provided with a full pressure lubricating oil system and shall include engine driven positive displacement pump, engine mounted duplex oil strainer and filter with automatic bypass, lubricating oil cooler and appurtenances, complete with pipe fittings and valves. Oil cooler shall be removable-core type.

**2.5 Cooling System** The engine cooling system shall consist of a radiator, forced draft fan with horizontal air discharge, V-belt driven from the engine

crankshaft, complete with thermostatic control valve and with a capped make-up water filling nozzle. Radiator shall have gravity shutoffs and provisions for extension of a venting thread.

**2.6 Engine Exhaust System** A complete exhaust system shall be provided for the engine and shall consist of a flexible exhaust connection not less than two feet long, piping, and residential type exhaust silencer. The flexible exhaust connection shall consist of a convoluted seamless steel tube without joints or packing, with flanged ends. The exhaust silencer shall be cylindrical, horizontal outdoor mounting, constructed of aluminum sheet having a minimum nominal thickness of 0.06 inch, with flanged connections. Sizes shall be as recommended by engine manufacturer. Asbestos insulation for the exhaust silencer flexible connection and one 90-degree long radius elbow shall be provided for each engine. Spark suppression is required for exhaust silencer.

**2.7 Engine Air Induction System** The air induction shall be equipped with a heavy-duty-type air cleaner with silencer. The silencer shall be able to reduce the intake air noise level substantially below the audible mechanical noise level of the engine.

**2.8 Starting System** The engine shall be equipped with a compressed air starting system. The equipment furnished shall include air starting motors, dual motor and engine driven air compressor, air receivers, shut-off valves, pressure reducing valves, indicating pressure gauges and safety relief valves. The starting air motor shall be rigidly attached to the engine. The starting piston shall be arranged to disengage automatically when the engine starts. Lubrication for the starting air motor shall be accomplished by the use of a siphon oiler.

**2.8.1 Air Compressor** shall consist of an air-cooled compressor, not less than 2.5 cu in piston displacement, V-belt driven by an electric motor for operation on 208-volt 3-phase 60-cycle a-c, complete with pressure switch, with provisions to transfer the V-belt drive to an air-cooled manually-started gasoline engine. Size of engine shall be as recommended by the air-compressor manufacturer. Engine exhaust silencer and exhaust flexible connection shall be supplied with the engine. Silencer shall be suitable for outdoor mounting. Discharge pressure of air compressor shall be as recommended by the engine manufacturer. Pressure drop between air receiver and air starting motor does not exceed 5 psi.

Motor engine and compressor shall be mounted on a common steel subbase for concrete floor mounting.

2.6.3 Air receivers shall be cylindrical, vertical, for concrete floor mounting, capable of withstanding the required storage pressure necessary for starting the engines and shall conform to test codes of ASME Code of Unfired Pressure Vessels. The volume for each tank shall be sufficient to furnish air for starting one diesel engine a minimum of 6 starts. The air receiver shall be complete with pressure gage, safety valves, drain valve and a two-foot long flexible connection for connecting compressor and receiver piping. Flexible connections shall also be provided for air supply to the starting air motors. Sizes should be equal to starting air motor lines.

2.9 Control Panel The engine shall be provided with a suitable control panel mounted on the unit, adequately supported and isolated from vibration. Instruments shall be the back connected, flush mounting type, mounted on the panel to permit accurate readability. Instruments and controls which are required or recommended by the diesel engine manufacturer for normal operating purposes shall be furnished, but shall include the following:

- (a) Fuel oil pressure gage
- (b) Lubricating oil pressure gage
- (c) Cooling water temperature indicator
- (d) Lubricating oil temperature indicator
- (e) Hour meter (running time totalizer, 3-digit cyclometer)

2.10 Safety Shutdown Controls Controls that will function to immediately shut off delivery of fuel to engine cylinders when actuated by a condition of overspeed shall be provided. The values at which shutdown controls shall be actuated as recommended by the engine manufacturer. Contacts shall be provided to trip the remote main circuit breaker.

2.11 Safety Alarm System Safety alarms shall be provided which will indicate abnormal operating conditions, low lubricating oil pressures, and high coolant temperature. Alarm settings shall be as recommended by the diesel engine manufacturer. Abnormal operating conditions shall be indicated by a general audible alarm and a visual alarm to indicate the specific abnormality. The alarm system shall be interconnected with the engine control to render it inoperative during normal engine starting and stopping, and shall be suitable for operation on 220-V a-c. Contacts shall be provided for connection to a remote alarm circuit.

**2.12 Generator** The generator shall conform to the requirements of ASA Standard C50.1, except the requirements for brushes, brushholders, collector rings, and associated features. The generator shall be rated for continuous full load operation with a 2-hour 25-percent overload, based on an ambient temperature of 40 degrees centigrade (C), a power factor of 0.8 lagging, 230 volts, 60-cycle three-phase AC output, at the rated voltage and relative speed. The generator shall be the revolving field, brushless, synchronous type, having amortisseur windings and directly connected or coupled to the engine crankshaft. Enclosures shall be the splashproof type with ventilating openings covered with removable screens having a mesh not larger than 1/2-inch. The inherent voltage regulation shall not exceed 40 percent. With the generator operating at rated open circuit voltage and relative speed, the difference between any two terminal voltages shall be not greater than two percent. Unless otherwise specified, the insulation shall be Class B, having a 50°C temperature rise rating. Polyphase generators shall have all phase lead coil ends brought out and externally connected. When used, collector rings shall be located on the end of the generator away from the engine. Generator shall be suitable for parallel operation with similar units.

**2.13 Voltage Regulation** The 230-volt output shall be manually adjustable throughout range of plus or minus 3 percent. The voltage regulator system shall be a static type, suitable for single and parallel operation of the generators. Voltage regulator rheostat shall be furnished for remote mounting. Main field rheostat, if required, and voltage regulator shall be mounted on the generator.

**2.14 Excitation** The exciter system shall operate in conjunction with the automatic voltage regulator to supply the necessary generator excitation when the generator is connected for single or parallel operation with loads ranging from 5 to 125 percent of rated generator output. The exciter shall be of the fast-response static type, multi-phase, enclosed in a sheet-metal housing mounted integrally with the engine-generator unit. The exciter shall provide a regulation not exceeding 3 1/2% from no load to full load.

**2.15 Lifting Attachments** The generator set shall be provided with suitable lifting attachments to enable its being lifted in its normal position. The attachments shall be located so that, when hoisted, adequate clearance will exist between lifting slings and all exterior parts of the generator set. Lifting attachments shall be positioned in such direction that the lifting strain will be in line with the longitudinal axis (peripheral plane) of the eye of the attachment.

**2.16 Treatment and Painting** Except for the engine, parts subject to high temperature, and electrical equipment not required to be fungus proofed, which shall be treated and painted in accordance with the manufacturer's best standard practice, the generator set shall be cleaned, treated, and painted in accordance with manufacturer's standard practices.

**2.17 Instruction Plates** The generator set shall be equipped with instruction plates suitably located, describing any special or important procedure to be followed in operating and servicing. Plates shall be of a copper-base alloy and shall be securely affixed thereto with brass screws or bolts of not less than 1/8-inch diameter.

**2.18 Wiring Diagrams** The generator set shall be provided with a wiring diagram showing all electrical circuits with identification of all terminals.

**2.19 Parts and Service** Engine generator sets purchased under this specification will be installed and operated at a location in rural Thailand. The supplier shall submit evidence of satisfactory availability of complete parts stock and service in Thailand.

**3.0 Switchboard:** Switchboard shall be NEMA Class 3, for 240-volt 3-phase 3-wire 60-cycle a-c service, free-standing, 75-inches high, bottom cable entry, consisting of four generator control sections, feeder circuit breakers, transformer section and distribution panelboard. Switchboard shall be composed of sections of uniform depth. Overall length should not exceed 200 inches. Switchboard and switchboard devices shall comply with applicable IEEE and NEMA standards.

**3.1 Bus** shall be copper or aluminum with silver plated joints, tinned or covered. Main bus shall be rated 2500 amperes. Buswork shall be braced to withstand a short-circuit of not less than 25,000 symmetrical amperes. Bus shall be sized to limit temperature rise to 40°C. ambient. Silicon-bronze hardware shall be used for bus connections. A 3/8-inch ground bus shall be provided, located near the bottom and extending the full length of the switchboard.

**3.2 Instruments** shall be 4 1/4-inch square switchboard type, long scale, semi-flush mounting, except synchroscope shall be 8 3/4-inch square.

3.3 Arrangement left-to-right facing the board shall be as follows:

Swing Synchronizing Panel  
Generator No. 2 (250 kw)  
Generator No. 3 (250 kw)  
Generator No. 4 (150 kw)  
Generator No. 5 (150 kw)  
Feeder and Metering Section  
Transformer Section  
Distribution Panelboard  
Switchboard shall have provisions for expansion to left (Generator No. 1 is future)

3.4 Swing Synchronizing Panel shall contain one synchroscope, two voltmeters, two frequency meters, and synchronizing lights, with appropriate nameplates and simplified instruction plate. Necessary bus P.T.'s shall be provided.

3.5 Generator No. 2 (250 kw) shall contain the main circuit breaker and controls for a 250-kw (312 kva 0.8 pf) 230-volt generator. Main circuit breaker shall be a 1,000-amp draw-out low-voltage power circuit breaker, electrically operated, with series trip cells. Closing and tripping power shall be taken from generator incoming terminals. Instrumentation shall include circuit-breaker control switch and indicating lights, three ammeters, wattmeter, voltmeter, synchronizing switch with removable handle, drilling for mounting of voltage-regulator rheostat and governor-motor control switch, and necessary current transformers and potential transformers. Provisions shall be made for extension of a circuit to remote trip contacts for the main circuit breaker.

3.6 Generator No. 3(250 kw) shall be same as Generator Section No. 2.

3.7 Generator No. 4 (150 kw) shall be similar to Generator Section No. 2, except with 600-amp trip cells and metering for a 150-kw (167 kva 0.8 pf) generator. Main breaker frame size and bussing shall be adequate to permit future increase to 250 kw.

3.8 Generator No. 5(150 kw) shall be same as Generator No. 4.

3.9 Feeder and Metering Section containing the following 3-pole molded-case air circuit breakers:

4 ea. 400 amp, interchangeable trip (one for transformer)

3 ea. 225 amp, non-interchangeable trip

1 ea. 150 amp, non-interchangeable trip

Space for two, 225-amp frame

**Metering panel with:**

1 set ground detector lamps and test switch,

1 voltmeter

1 voltmeter switch

1 wattmeter semi-drawout, 2-element, 3-phase, 3-wire  
with C.T.'s to measure power flowing into the feeder section.

**3.10 Transformer Section** containing one 3-phase 240 delta-208 Y/120 volt, 112 1/2-kva dry-type transformer, Class H insulation, 2-2 1/2% primary voltage taps FCABN. Transformer enclosure shall be sealed or ventilating openings shall be provided with filters, screens and guards adequate to prevent the entrance of small rodents, vermin and dust.

**3.11 Distribution Panelboard** shall be rated 3-phase 4-wire S/N 400-amp bus, directly connected to secondary of transformer, with the following bolted-type 3-pole molded-case circuit breakers:

5 ea. 225-amp interchangeable trip

1 ea. Space for 225-amp frame.

**4.0 Fungus Resistance:** Electrical connections, including terminal and circuit connections, components, and circuit elements shall be coated with varnish conforming to Specification MIL-V-173 except that:

- (a) Components and elements inherently inert to fungi or hermetically sealed need not be treated.
- (b) Components and elements whose operation will be adversely affected by the application of varnish shall not be treated.

**5.0 Procurement List:** The following items and quantities shall be purchased:

<u>Item No.</u>	<u>Description</u>	<u>Quantity</u>
1a	Diesel electric generator, 250 KW rating, radiator cooled, air motor start, complete with exhaust flexible connections, exhaust silencer, air intake filter with silencer, 90° long radius exhaust elbow with exhaust piping insulation. Unit shall be complete in all respects ready for connecting fuel and air supply lines in the field. One complete spare set of filter-elements shall be furnished, packed with the unit.	3 Ea.
1b	Generator-same as Item-1 except 150 KW	2 Ea.
1c	Dual-driven air compressor	1 Ea.
1d	Air receiver complete with safety valves, pressure gage and drain valve	2 Ea.
1e	Motor driven diesel fuel transfer pump	1 Ea.
1f	Wall mounted rotary type hand pump	1 Ea.
1g	Flexible pipe connections for the following:	
	For exhaust pipe of engine-driven compressor	1 Ea.
	For fuel supply line	3 Ea.
	For fuel return line	3 Ea.
	For air supply line	3 Ea.
	For air line connecting air receivers and air compressor	1 Ea.
2	Switchboard, 240V, 3-phase, 3-wire	1 Ea.

6.0 Preparation for Overseas Shipment: Material shall be preserved, packaged, and packed in accordance with the manufacturer's highest standard for overseas shipment.

7.0 Import Material List: The contractor shall prepare and furnish separately a list (6 copies) of the material within each shipping container.

**8.0 Shop Drawings:** Contractor shall furnish six prints and one reproducible copy of shop drawings for the engine-generator set and switchboard, and seven copies of operating and instruction manuals and parts lists for all mechanical and electrical equipment and devices.

- End of Specification -